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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/851,313	05/09/2001	Tatsuya Usami	NEC01P069-MSb	2820
21254	7590	02/24/2004	EXAMINER	
MCGINN & GIBB, PLLC 8321 OLD COURTHOUSE ROAD SUITE 200 VIENNA, VA 22182-3817			MALDONADO, JULIO J	
			ART UNIT	PAPER NUMBER
			2823	

DATE MAILED: 02/24/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/851,313

Applicant(s)

USAMI, TATSUYA

Examiner

Julio J. Maldonado

Art Unit

2823

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 01 December 2003.
2a) ☒ This action is FINAL. 2b) ☐ This action is non-final.
3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-8 and 31-46 is/are pending in the application.
4a) Of the above claim(s) _____ is/are withdrawn from consideration.
5) ☐ Claim(s) _____ is/are allowed.
6) ☒ Claim(s) 1-8 and 31-46 is/are rejected.
7) ☐ Claim(s) _____ is/are objected to.
8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 08/26/2003.
4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claim 46 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claim 46 recites, "...the semiconductor device according to claim 3, wherein said methylated hydrogen silsesquioxane...". However, there is no description of a "methylated hydrogen silsesquioxane" as claimed in claim 3 or claim 1, thus rendering the claim indefinite.

Claim Rejections - 35 USC § 102

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

3. Claims 1, 3, 5, 7, 34, 37, 38 and 41-44 are rejected under 35 U.S.C. 102(e) as being anticipated by Lu et al. (U.S. 6,008,540).

In reference to claims 1, 5, 41 and 42, Lu et al. (Figs.2b and 3f) teach a multi-layered insulation film formed on a semiconductor substrate (102), said multi-layered insulation film comprising a first insulation layer comprising an organic material (342, and column 1, lines 24 – 33) having a dielectric constant which is lower than a silicon oxide dielectric constant; a second insulation layer (344) comprising a polysiloxane compound having an Si-H group and formed on and adhering to a top of said first

insulation layer (342); a third insulation layer (346) comprising an inorganic material and formed on and adhering to a top of said second insulation layer (344); and a plurality of wires embedded in a groove formed in said multi-layered insulation film, said multi-layered insulation film being disposed between said wires (column 3, line 48 – column 6, line 62).

In reference to claims 3 and 7, Lu et al. teach wherein said second insulation layer comprises hydrogen silsesquioxane (column 5, lines 1 – 10).

In reference to claims 4 and 8, Lu et al. teach wherein said third insulation layer comprises silicon oxide (column 5, lines 11 – 14).

In reference to claim 34, Lu et al. teach wherein said first insulation layer comprises a thickness greater than a thickness of said second insulation layer, and wherein said first insulation layer comprises a thickness greater than a thickness of said third insulation layer (Fig.3f).

In reference to claim 37, Lu et al. teach wherein a bottom of said groove is formed on a same surface as said first insulation layer (Fig.3f).

In reference to claim 38, Lu et al. teach wherein said plurality of wires comprises copper wires (column 6, lines 49 – 62).

In reference to claim 43, Lu et al. teach wherein said first insulation layer, said second insulation layer and said third insulation layer of said multi-layered insulation film comprise substantially uniform widths (Fig.3f).

In reference to claim 44, Lu et al. teach wherein a surface of said multilayered film is substantially coplanar with a surface of said plurality of wires (Fig.3f).

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claims 2, 6, 31 and 32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lu et al. ('540) as applied to claims 1, 3, 5, 7, 34, 37, 38 and 41-44 above, and further in view of the applicants' admitted prior art in the instant application.

The teachings of Lu et al. substantially teach all aspects of the invention but fails to show that the first insulation layer comprises an alkyl silisesquioxane having a dielectric constant of no greater than 3.5. However, the prior art (Figs.6a-c) teaches a first insulation layer (2) comprising an alkyl silisesquioxane having a dielectric constant of no greater than 3.5 (page 1, line12 – page 6, line 13). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention was made to use an alkyl silisesquioxane as taught by the prior art in the interconnect structure of Aoi and Jeng, since this would decrease inter-wire capacitance (page 1, line 12-15).

6. Claim 33 is rejected under 35 U.S.C. 103(a) as being unpatentable over Lu et al. ('540) and the prior art as applied to claims 1-3, 5-7, 31, 32, 34, 37, 38 and 41-44 above, and further in view of Aoi (U.S. 6,333,257 B1).

The combination of Lu et al. and the prior art teach using low-contact interlayer dielectrics such as Teflon and polyamides (Lu et al., column 1, lines 24 – 33) but fail to teach using first insulation layer comprising polyaryl ether. However, Aoi (Figs.4a-11c)

Art Unit: 2823

teaches a multilayered insulation film having wiring embedded therein, wherein interlayer insulation layer (204) comprises any arbitrary material such as Teflon, polyamide and polyaryl ether (column 10, lines 1 – 11). It would have been within the scope of one of ordinary skill in the art to combine the teachings of Lu et al. and the prior art with the teachings of Aoi to enable using the dielectric materials of Lu et al. and the prior art as taught by Aoi because one of ordinary skill in the art at the time the invention was made would have been led to the conclusion that the selection of known materials based on its suitability for its intended use supported a prima facie obviousness. MPEP 2144.07.

7. Claim 35, 36 and 45 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lu et al. ('540) as applied to claims 1, 3, 5, 7, 34, 37, 38 and 41-44 above, and further in view of Jeng (U.S. 6,054,769).

Lu et al. substantially teach wherein said second insulation layer is an adhesion layer (column 4, lines 1 – 10) but fail to disclose wherein the second insulation layer comprises a first layer placed in said first layer, wherein the second insulation layer comprises methyl silsesquioxane and wherein said second insulation layer is formed by one of a plasma CVD and a spin coating process where said semiconductor substrate is continuously maintained in a plasma atmosphere. However, Jeng (Fig.1) teaches a multilayered insulation film including a first (18), second (20) and third (22) insulation layer, wherein said second insulation layer (20) comprises hydrogen silsesquioxane and a hydride organosiloxane, wherein said second insulation layer (20) comprises a first layer and a second layer placed in said first layer, and furthermore, wherein said second

Art Unit: 2823

insulation layer is formed by using a plasma CVD (column 4, line 60 – column 5, line 5).

It would have been within the scope of one of ordinary skill in the art to combine the teachings of Lu et al. and Jeng to enable using the dielectric materials for the second insulation layer of Lu et al. as taught by Jeng because one of ordinary skill in the art at the time the invention was made would have been led to the conclusion that the selection of known materials based on its suitability for its intended use supported a prima facie obviousness (MPEP 2144.07), and furthermore because it would provide adhesion and protection to the low-k dielectric materials (column 5, lines 1 – 5).

8. Claims 39 and 40 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lu et al. ('540) as applied to claims 1, 3, 5, 7, 34-37, 38 and 41-45 above, and further in view of Allada et al. (U.S. 6,218,317 B1).

Lu et al. teach a second insulation comprising hydrogen silsesquioxane, but fails to teach using a methylated hydrogen silsesquioxane film (MHSQ) at a thickness of about 50nm. However, Allada et al. (Figs.1a-1b) in a related art to the formation of an interconnect structure teach a second insulating film comprising a methylated hydrido organo siloxane polymer (column 2, lines 7 – 58). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention was made to use the insulating layer as taught by Allada et al. in the interconnect formation structure of Lu et al., since this dielectric layers exhibit low dielectric constants (column 2, lines 36-48).

Still, the combined structure of Lu et al. and Allada fail to teach the dielectric layer having a thickness of about 50nm. Notwithstanding, it would have been an

obvious matter of design choice bounded by well known manufacturing constraints and ascertainable by routine experimentation and optimization to choose these particular dimensions because applicant has not disclosed that the dimensions are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical, and it appears prima facie that the process would possess utility using another dimension. Indeed, it has been held that mere dimensional limitations are prima facie obvious absent a disclosure that the limitations are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical. See, for example, *In re Rose*, 220 F.2d 459, 105 USPQ 237 (CCPA 1955); *In re Rinehart*, 531 F.2d 1048, 189 USPQ 143 (CCPA 1976); *Gardner v. TEC Systems, Inc.*, 725 F.2d 1338, 220 USPQ 777 (Fed. Cir. 1984), cert. denied, 469 U.S. 830, 225 USPQ 232 (1984); *In re Dailey*, 357 F.2d 669, 149 USPQ 47 (CCPA 1966).

Response to Arguments

9. Applicant's arguments with respect to claims 1-8 and 31-42 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

10. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within

Art Unit: 2823


TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

11. Any inquiry of a general nature or relating to the status of this application should be directed to the Group Receptionist whose telephone number is 571-272-2800. See MPEP 203.08.

12. Any inquiry concerning this communication or earlier communications from the examiner should be directed to examiner George Fourson whose telephone number is (571) 272-1860. The examiner can normally be reached on Monday through Friday.

13. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri, can be reached on (571) 272-1855. The fax number for this group is 703-872-9306 for before final submissions, 703-872-9306 for after final submissions and the customer service number for group 2800 is (703) 306-3329.

Updates can be found at <http://www.uspto.gov/web/info/2800.htm>.


George Fourson
Primary Examiner
Art Unit 2823

Julio J. Maldonado
February 19, 2004